

*The open access (OA) movement has had some big wins this year: In July, a cross-party group of British politicians called on the U.K. government to make all publicly funded research accessible to everyone "free of charge, online." That same month, the U.S. House of Representatives Committee on Appropriations recommended that all NIH-funded research be made freely available 6 months after publication. But where did the OA movement come from, and where is it taking us?*

For the genesis of the OA movement, we need to step back 10 years, to June 1994, when professor of cognitive science Stevan Harnad posted what he called a "subversive proposal" to the Electronic Journals mailing list at Virginia Polytechnic Institute.

Harnad's post consisted of a simple but radical proposition: Since researchers' only interest in publishing is to share their ideas with as many of their peers as possible—and they are, therefore, happy to give their papers away—the price tag of journal subscriptions not only imposes an undesirable restriction on that sharing but, in the age of the Internet, is no longer even necessary. Consequently, he concluded, researchers should immediately start self-archiving their papers on the Internet, thereby maximizing the impact of their ideas and more effectively reaching "the eyes and minds of peers, fellow esoteric scientists and scholars the world over."

While most mailing list messages instantly fall into justifiable oblivion, Harnad's proposal sparked a seminal online debate (one, ironically, was later published as a book) and immediately became the de facto manifesto of the embryonic OA movement.

A decade later, OA is now threatening to overturn the \$6 billion scholarly publishing industry and is forcing even the largest publishers against the ropes. Earlier this year, for instance, the CEO of Reed Elsevier was obliged to appear ignominiously before British politicians to explain why he thought it acceptable for publishers to make a 34-percent profit from selling publicly funded research back to the very people who had (freely) provided it in the first place: namely, researchers and their institutions.

But how did the OA movement grow from one apparently random message on a mailing list to the powerful force for change that it represents today?

## Not the First

Of course, Harnad was not the first to see the Internet's potential for enabling new ways of sharing research. Leaving aside pre-Web luminaries like Ted Nelson and Web creator Tim Berners-Lee, physicist Paul Ginsparg had founded the Internet's first preprint service, arXiv, 3 years prior to Harnad's message.

Created to allow physicists to share their ideas more quickly than the lengthy process of publication permitted, arXiv had 20,000 users by the time Harnad posted the Subversive Proposal and was receiving 35,000 hits per day. For this reason, Harnad cited arXiv as a proof of concept, although his ambitions were somewhat grander.

Nor was Harnad the first to climb over the access barrier imposed by journal subscriptions. Charles Oppenheim, professor of information science at Loughborough University, points out that librarians had been "banging on about the high costs of subscribing to journals published by commercial publishers" for a long time. As these costs increased, librarians were having to cancel journals, depriving faculty of access to them. Indeed, many trace the roots of the OA movement to the growing activism of librarians who, in pursuit of remedies to the growing problem of journal price inflation, founded the Scholarly Publishing and Academic Resources Coalition (SPARC) advocacy group in 1998.

But where SPARC's initial focus was on advocating for alternative, less costly journals and arXiv was a central, discipline-based repository of preprints, Harnad wanted to see the entire corpus of scholarly literature made freely available on the Internet—a goal that he believes could be best achieved by researchers continuing to publish in traditional journals, but then self-archiving their articles locally.

Moreover, obsessed with making the revolution happen—and blessed with a facility for rhetoric and argumentation that few can equal—Harnad has spent the last 10 years cajoling, hectoring, haranguing, and pleading with fellow researchers and verbally battering critics into submission (or at least bruised silence).

Thus, while Harnad cannot claim to have invented the OA movement, his phenomenal energy and determination, coupled with a highly focused view of what is needed, undoubtedly earns him the title of chief architect of open access.

Indeed, over the years many others have "independently discovered" the self-evident logic of OA, but few have matched Harnad's focused energy—those who have often proved to be prone to naiveté. In 1999, for example, when Nobel prize winner—and the then-director of the NIH— Harold Varmus proposed a new biomedical research literature server called E-Biomed, he appeared to assume that publishers only needed to be asked to open their content vaults to the public.

Modelled on arXiv, E-Biomed was mooted as "an electronic public library of medicine and other life sciences" consisting of a comprehensive, fully searchable free repository of full-text research articles, including both preprint and post-print texts. By the time it was launched as PubMed Central in February 2000, however, the project was a pale shadow of Varmus' initial concept.

Why? Because, despite widespread support from scientists, publishers and learned societies mounted an aggressive campaign of opposition to E-Biomed. As a consequence, the preprint component was eliminated and delays were introduced between article publication and posting to the archive. Moreover, since publishers routinely acquire the copyright for papers that they publish, PubMed Central relied on publisher co-operation. Due to this fact, it's no surprise that 4 years after its launch, only 161 journals (most of which are freely available elsewhere on the Web) are currently archived with PubMed Central.

Varmus evidently decided that publishers needed to have their arms twisted a little. Therefore, in November 2000, he founded the Public Library of Science (PLOS) with scientists Michael Eisen and Patrick Brown. The aim was to persuade fellow scientists to sign an open letter pledging to discontinue submitting papers to any journal that refused to make the research articles it published "available through online public libraries of science such as PubMed Central" 6 months after publication.

PLOS was a great cause and it attracted nearly 34,000 signatures from scientists in 180 countries. But, while a small handful of publishers complied, most blithely ignored the PLOS letter. Worse, most of the scientist signatories were happy to forswear their own petition and continued publishing in the very journals that had turned a deaf ear to their request.

What Varmus and his PLOS colleagues had failed to appreciate is that most publishers would rather give their eyeteeth than cooperate in any scheme that threatens their profits.

More realistically, Harnad has always tended to assume that, rather than going cap-in-hand to publishers, researchers should simply "free the refereed literature" themselves.

That said, there was a naive element to the Subversive Proposal, too, since Harnad's plan would have led to researchers posting their papers on thousands of isolated FTP sites. This would have meant that anyone wanting to access the papers would have needed prior knowledge of the papers' existence and the whereabouts of every relevant archive. They would then have had to search each archive separately. Today, Harnad concedes that "anonymous FTP sites and arbitrary Web sites are more like common graves, insofar as searching is concerned."

## Self-Archiving Toolkit

For this reason, Harnad also became an ardent advocate for the creation of a self-archiving toolkit that could provide the OA movement with the means to compete with the electronic platforms that publishers were developing as they began to offer subscription-based online access to their journals. It is no accident that many of the OA tools subsequently produced were developed at Southampton University, where Harnad moved shortly after posting the Subversive Proposal.

In 2000, for instance, Southampton University's Department of Electronics and Computer Science released EPrints software. Designed to enable institutions to create interoperable archives for researchers to post their papers, EPrints software utilizes common metadata-tagging standards developed under the JISC-funded Open Archives Initiative (OAI), thereby enabling multiple distributed archives to be treated as one virtual archive.

And, to enable this virtual archive to be searched, a number of OAI "Googles" were developed—most notably the University of Michigan's OAIster. By regularly harvesting records from diverse OAI-compliant repositories, OAIster aggregates the content from the entire population of OAI-compliant archives, enabling them to be cross-searched via a single search interface.

Once relevant articles have been discovered, researchers can then utilize Southampton University's ParaCite service to locate the most accessible full-text version available on the Web simply by pasting a paper's abstract into the ParaCite search box and following the links.

And those wanting to assess the impact of self-archived papers can use Southampton University's CiteBase, which is able to rank self-archived articles by a number of factors, including most-cited author, paper, etc.

Meanwhile, apparently oblivious to such developments, publishers were engaged in an orgy of consolidation, and, today, the two largest STM publishers, Elsevier and Springer, between them control around 40 percent of the STM journal market. Growing concerns about such consolidation, however, were to provide even greater rationale for OA.

## OA Publishing

But one publisher did see the approaching storm. Conscious that the core issue was not costs, per se, but, rather, the barrier that the traditional subscription model imposed between reader and research, Vitek Tracz, the chairman of Current Science Group, decided that rather than posing a threat to publishers, OA offered a new opportunity. By shifting costs from the reader to the author, he concluded that publishers could make research articles freely available, yet still charge for publication.

In 1998, therefore, Tracz sold a number of publishing businesses to Elsevier and founded the world's first commercial OA publisher, BioMed Central (BMC). Rather than charging readers (via subscriptions) to access its journals, BMC charges authors to publish their papers. Today, BMC publishes 110 Web-only journals in the biological and medical sciences—all of which are immediately released on the Web as well as archived in PubMed Central.

The OA publishing model was a novel and creative response to the growing demands from OA advocates. "The fact that Vitek Tracz put his money where his mouth is by starting BioMed Central as an open access publishing company was a major commitment to open access that hadn't been there before, and a breakthrough," says BMC publisher Jan Velterop. To have a commercial publisher embrace OA also provided a powerful credibility boost to the movement.

By now conscious of the limitations of advocacy and impressed with what BMC was doing, PLoS reinvented itself in 2001 as an OA publisher and set about establishing new OA journals. Last October, *PLoS Biology* was launched; this month (October), the first issue of its second journal, *PLoS Medicine*, will be published.

"Public Library of Science began as an advocacy group for the NIH archive, PubMed Central," Varmus recently explained to *The Scientist*. "Subsequently, it became a publishing house."

However, the development of OA publishing was to sow the seeds for future discord in the movement. It was, after all, a deviation from Harnad's original concept, which had assumed that researchers would continue to use traditional journals, but then self-archive their papers.

True, Harnad had anticipated that publishers might eventually need to downsize, perhaps eventually to provide peer-review services alone, but OA publishing had created a new type of journal. While this met the growing calls for all published research articles to be freely available, Harnad became increasingly concerned that it could hamper progress.

In 2002, however, there was sufficient good news to paper over any potential cracks in the movement. In December, PLoS received a \$9 million grant from the Gordon and Betty Moore Foundation. More significantly, earlier in the year, philanthropist George Soros' Open Society Institute (OSI) had provided \$3 million in funding for the movement, enabling the Budapest Open Access Initiative (BOAI) to be launched.

In contrast to PLoS, BOAI was heavily focused on practical measures: Rather than asking people to sign a petition, it called on them to agree on "a statement of principle, a statement of strategy, and a statement of commitment."

"It is clear in retrospect that most of those signing on to the PLoS boycott did so with their fingers crossed," Harnad commented to *Information Today* at the time. "But the BOAI is not another petition like the PLoS. Signing it does not mean that one supports the cause, or that one is asking someone else (e.g., the publishers) to do something. Signing means that one is oneself (whether individual or institution) committing to do something—either self-archiving or submitting to alternative journals or both."

Moreover, with \$3 million in the bank, it was now possible to make that commitment real. As Harnad pointed out to the BBC: "To start up and fill an institutional Eprint Archive costs less than \$10,000; to start up and fill an alternative journal costs less than \$50,000; so \$3 million can do a lot of good."

Importantly, the BOAI also articulated the first widely agreed definition of OA, which stipulates that OA research articles are freely available "on the public Internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the Internet itself."

And since the BOAI recognized that there were now two flavors of OA, it was more than a simple restatement of the Subversive Proposal. To this end, it outlined a two-pronged strategy: BOAI-1 was the self-archiving (or green) route outlined in the Subversive Proposal; BOAI-2 was OA publishing (the gold road), as practiced by BMC and PLoS.

In short, the BOAI was a defining moment. Not only did it significantly raise the public profile of the movement, but it also accelerated its progress. "When you consider that we didn't have a commonly recognized name for 'open access' before the Budapest Open Access Initiative, I think the build-up of momentum in just the past two-and-a-half years has been astonishing," says Rick Johnson, director of SPARC.

## Shift of Focus

But, with access to substantial funds, BMC and PLoS were now better equipped than Harnad to set the OA agenda. To promote their activities, for instance, the two publishers initiated a series of "me too" declarations and manifestos that added little to what had been expressed in the BOAI, but, in Harnad's view, laid disproportionate stress on OA publishing, and downplayed self-archiving.

Thus, in June 2003, the Bethesda Statement on Open Access Publishing was announced. In October 2003 came the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities. Unfortunately, says Harnad, while these were "all excellent PR" for OA journal publishing, they did little for the self-archiving cause. For instance, he says, there was "no mention or understanding of BOAI-1 in the Berlin Declaration."

To rub salt into Harnad's wounds, when earlier this year BOAI published a breakdown of how it was spending the Soros money, it transpired that 71 percent had gone to BOAI-2 and just 29 percent to BOAI-1.

But, if the aim of the OA movement is to provide unfettered access to research on the Internet, does it matter whether this is achieved via OA publishing or through self-archiving? In the short term, yes, says Harnad, since placing too much stress on OA publishing threatens to slow the adoption of OA.

Firstly, the author-pays model of OA publishing has become the bogeyman of OA. With costs ranging from \$525 per paper at BMC to \$1,500 at PLoS, author-pays is viewed by many as a strong disincentive to embrace OA. BMC and PLoS have been keen to stress that when an author cannot afford to pay, the charge will not be levied. They insist that the intention is for publishing fees to be paid by an author's institution or funder, not by individual authors. To formalize this, they have introduced annual "membership" schemes, allowing institutions to bulk-purchase the right for their researchers to publish future articles. However, many feel this is uncomfortably similar to the widely-criticized "big deal" site licenses introduced by traditional publishers seeking to sell online access to their journals.

Thus, while Tracz's innovation provided credibility to the movement, it also introduced a hairball—one that cast doubt not only on OA publishing, but also, by implication, on the entire OA movement. Clearly conscious of this, in August BMC began consulting librarians and funders over future pricing models.

Harnad worries that overplaying OA publishing could retard the movement in another way. As he frequently points out, only 1,000 of the 24,000 scholarly journals are currently OA. This means that OA publishers can, at the most, only make 5 percent of the total refereed research output freely available. If, on the other hand, all researchers were to immediately begin self-archiving the papers that they publish in the 23,000 traditional journals, then 95 percent of the research output could be made OA. As Harnad puts it: "Self-archiving can provide toll-free access to all 2,500,000 annual articles in all 24,000 journals, virtually overnight."

Why, then, he asked Michael Eisen in a forthright online exchange in January, is PLoS "with its considerable resources promoting only open-access publishing (BOAI-2), instead of also promoting, *at least* as vigorously, the other road [BOAI-1]," which would almost certainly lead to universal open access?

What was apparently worrying Harnad was that the Subversive Proposal was itself being subverted.

Ironically, in the early days of OA, Harnad had himself proposed the author-pays model—a flirtation with OA publishing that he now regrets as "unnecessary and a strategic mistake on my part."

As he explains: "[I]t is now much clearer that OA self-archiving is not only the path to OA, but also the eventual path to OA publishing (but only after 100 percent OA itself has prevailed—through self-archiving)."

## Darkest Before the Dawn

By now, however, it had become evident that a far bigger challenge confronted the entire OA movement—both the gold and the green varieties. It turns out that offering exciting new publishing models, developing snazzy self-archiving tools, and extolling the virtues of OA all count for nothing if the primary agents of change—the researchers themselves—simply turn a deaf ear to the call.

That they are doing, Harnad conceded in July on the American Scientist Open Access Forum that he moderates: "[O]nly about 20 percent of authors are providing OA to their articles any which-way today (whether by publishing in a gold journal [5 percent], or by publishing in a green journal and self-archiving [15 percent])."

In short, you can lead a horse to water, but you can't make him drink. What has become "abundantly clear," concluded Harnad, is that "universities and research funders must extend their existing publish-or-perish mandate to mandate that the publications must be made OA—either by publishing them in an OA journal, wherever possible (5 percent) or publishing them in a non-OA journal (95 percent) and self-archiving them."

But here it seemed was yet another mountain to climb. Persuading universities and research funders to mandate researchers to embrace OA could take another 10 years.

Increasingly gloomy, Harnad treated with skepticism last December's news that the U.K. House of Commons Science and Technology Committee was conducting an inquiry into STM publishing. His skepticism only increased when—

despite his filing a written submission—the committee failed to call him to testify. Moreover, as the inquiry progressed, British politicians appeared to have little interest in or understanding of self-archiving.

Posting to his own mailing list in March, Harnad complained that the committee continued "to propagate this planetary tidal wave [in which open access is being equated exclusively with open access 'publishing,' instead of with open access 'provision.'"

Researchers giving evidence to the inquiry confirmed the general lack of interest in OA, with most arguing that there was no need to change the current system. As David Williams, professor of tissue engineering at the University of Liverpool, told the committee: "I do not see that there is any significant problem in S&T publishing at the present time. My staff, my post-docs, my students have immense access to a wide variety of publications with tremendous facility. Comparing that to 5 years ago, the time saved in technology is very, very significant."

But the darkest hour, they say, comes just before the dawn. On July 20, when the Select Committee's report was published, it was immediately apparent that British politicians had indeed understood the difference between OA publishing and self-archiving. Moreover, while expressing some caution about OA publishing, they recommended that the U.K. government create a network of institutional repositories without delay and *mandate* all publicly funded researchers to deposit copies of their articles in those repositories, thereby making them accessible to all "free of charge, online."

## A Prophet Whose Time Has Come

Harnad, who was attending a conference in Barcelona, could not have wished for more. What better way of fast-tracking OA than to have the government order researchers and their institutions to adopt self-archiving? Rushing to an Internet cafe, he triumphantly e-mailed that the news "could not have been better—though it could have come 10 years earlier."

But the good news did not end there. The same month, the U.S. House of Representatives Committee on Appropriations recommended that NIH—the largest science funder in the U.S. federal government—draw up a plan to ensure that all research articles resulting from NIH-funded research be archived in PubMed Central 6 months after publication.

At the time of this writing, similar proposals are being discussed in Canada, Scotland, Australia, India, and Norway. What we are witnessing, says Harnad, is "a historic race to see which nation actually implements the recommendation first."

Despite all his frustrations, it seemed that the Harnadian view of the universe had finally begun to prevail. Ten years after posting the Subversive Proposal, lacking the financial resources of international corporations like Elsevier, or the powerful PR machines at the disposal of BMC and PLoS, but possessing all the energy and commitment of a true zealot, Harnad had apparently outgunned them all. "You must feel like a prophet whose time has come!" one of Harnad's supporters e-mailed from Australia.

Ultimately, of course, the OA movement is a communal endeavor, not the work of one man alone, no matter how indefatigable that man may be. After all, disgruntled as Harnad may have become over the proliferation of manifestos and declarations, these did successfully attract the attention of politicians. The truth is that for OA to gain the mindshare that it enjoys today, it has taken the efforts of many—from the inspiration of individuals like Ginsparg, Varmus, and Tracz (to name a few) to the activism of librarians and the support (and funding) provided by a growing army of well-wishers. And, of course, without the Internet the very *raison d'être* of open access could not exist.

That said, without Harnad's focus and energy, a movement that many now believe is set to revolutionize the process of scholarly communication could still be bogged down in a bitter wrangle over journal prices.

But has the war truly been won? It is, after all, possible that the U.K. government will decline to implement the recommendations of the Science and Technology Committee and the NIH proposal may also fail or be emasculated. At the time of this writing, publishers and learned societies are mounting an even more aggressive campaign than the one that they conducted against E-Biomed. Might we once again see a spanner thrown in the works?

Whatever transpires, it is clear that traditional publishers can no longer ignore open access. In Part Two, I will explore in more detail how publishers are responding and pose the question: Is the self-archiving roadmap as straightforward as Harnad claims, or even sustainable?

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